31 minutes, 12 seconds. From the second root, $B=78^\circ\ 8'=5$ hours, 12 minutes, 32 seconds. Length of day=20 hours, 50 minutes, 8 seconds.

Values of B substituted in (1) give for the latitude $36^\circ\ 44'$ and $64^\circ\ 39'$.

III. **Solution by C. HORNUNG, A. M., Professor of Mathematics, Heidelberg University, Tiffin, O.**

Let Z be the zenith, P the pole, N the north point of the horizon, S the place on the horizon where the sun rises, and S' the place of the sun on prime vertical when it has moved half the way to the meridian. Also let ϕ=the required latitude, δ=the sun's declination$=23^\circ\ 27'\ 15''$, and P=the hour angle of the sun when rising. Then without allowing for refraction and semi-diameter, we get from the spherical triangles PNS and PZS', $-\cos P=\tan\phi\tan\delta$......(1); and $\cos\frac{1}{2}P=\cot\phi\tan\delta$......(2). From (1) and (2) we have $\tan^3\phi-(1/\tan\delta)\tan^2\phi+2\tan\delta=0$, or $\tan^3\phi-2.31224\tan^2\phi-.18704=0$. Whence $\tan\phi=2.27614$, and $\phi=66^\circ\ 16'\ 54''$ the required latitude. From (2) $P=158^\circ\ 1'\ 28''$. Hence from sunrise to noon is 10 hours, 32 minutes, 5.8 seconds, and the length of the day is 21 hours, 4 minutes; 11 seconds.

Solved by *J. SCHEFFER* with result, latitude $36^\circ\ 43'\ 31''$, and length of day 14 hours, 31 minutes, 6 seconds.

61. Proposed by COOPER D. SCHMITT, A. M., Professor of Mathematics, University of Tennessee, Knoxville, Tenn.

The product of n numbers, each the sum of four squares, may be expressed as the sum of four squares in $(48)^{n-1}$ different ways.

Solution by G. B. M. ZERR, A. M., Ph. D., President and Professor of Mathematics, The Russell College, Lebanon, Va.

In Vol. II, No. 2, page 47, it is demonstrated that the product of two numbers each the sum of four squares may be expressed as the sum of four squares in 48 different ways.

Let $a_1^2,\ a_2^2,\ a_3^2,\ a_4^2\ldots\ldots a_n^2$ be the n squares.

Then $a_1^2a_2^2=(m_1^2+m_2^2+m_3^2+m_4^2)$ in 48 ways.

$a_1^2a_2^2a_3^2=(m_1^2a_3^2+m_2^2a_3^2+m_3^2a_3^2+m_4^2a_3^2)=(n_1^2+n_2^2+n_3^2+n_4^2)$
in $4\times48\times48=2^2.48^2$ ways.

$a_1^2a_2^2a_3^2a_4^2=(n_1^2a_4^2+n_2^2a_4^2+n_3^2a_4^2+n_4^2a_4^2)=(o_1^2+o_2^2+o_3^2+o_4^2)$
in $4\times2^2.48^2\times48=2^4.48^3$ ways.

$a_1^2a_2^2a_3^2a_4^2a_5^2=(p_1^2p_2^2p_3^2p_4^2)$ in $4\times2^4.48^3\times48=2^6.48^4$ ways.

$\therefore\ a_1^2a_2^2a_3^2a_4^2\ldots\ldots a_n^2=(z_1^2+z_2^2+z_3^2+z_4^2)$
in $2^{2n-4}.48^{n-1}$ ways$=(2)^{2(n-2)}.(48)^{n-1}$ ways.